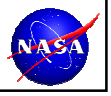
LP DAAC Status

Dave Meyer

Joint ORNL/LP User Working Group Meeting
Annapolis, MD
March 9-10, 2011

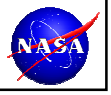
USGS



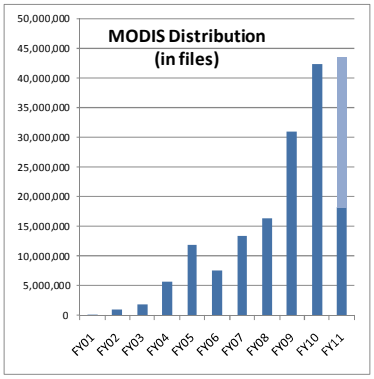
Topics

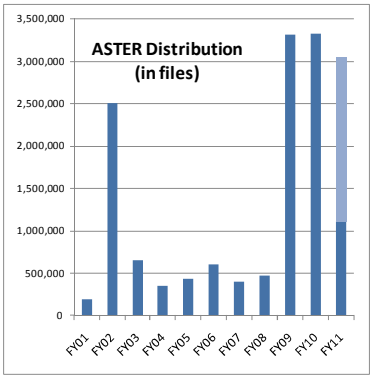
- Current distribution statistics
- Emergency response support
- Data access & interoperability activities
- New data sets
- New missions (including brief Landsat update)
- Challenges & opportunities

USGS



LP DAAC Science Data Distribution Trends



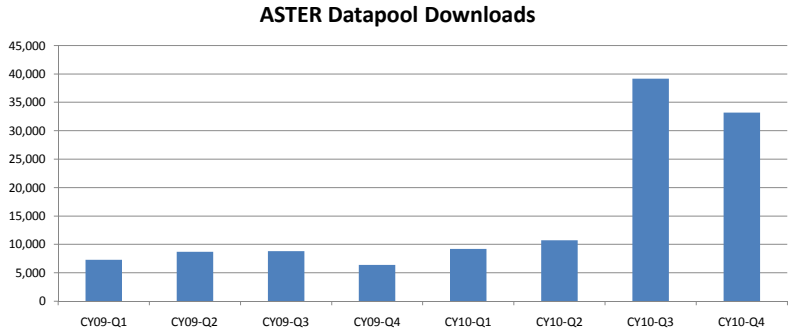


- Significant upward trends for both ASTER and MODIS
  - File Distribution : **~45 Million files distributed in FY10** (33% increase from FY09)
  - Volume Distribution : **~950 TB distributed in FY10**
  - Distinct Hosts : **~26k distinct hosts distributed to in FY10**

USGS

ASTER L1B Datapool Expansion

- The Datapool has historically held the most recent (2) years of ASTER L1B data over the U.S. and Territories
- In 2010, it was agreed at the ASTER Science Team that the Datapool would be expanded from two years to the full archive period
- The L1B Datapool now provides all L1B over the U.S. and Territories under Free and Open distribution
- The following chart demonstrates the impact this has had with Datapool downloads--



USGS

LP DAAC Emergency Response Support

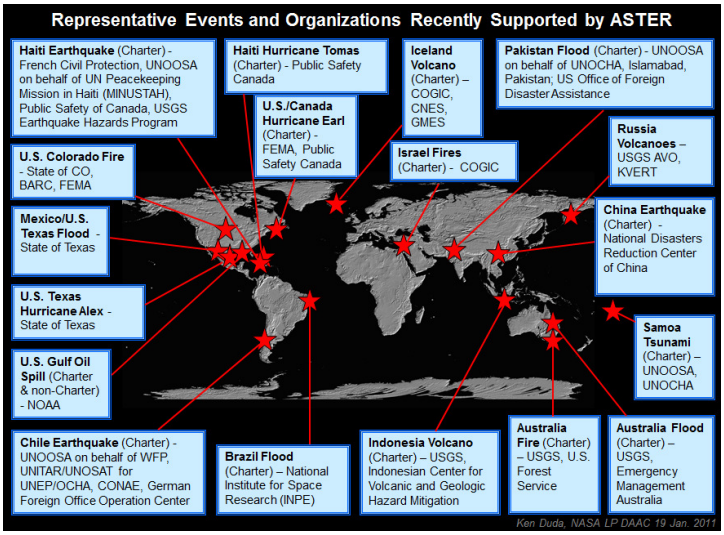
- Coordination of ASTER tasking
- ASTER Expedited data processing and distribution
- Coordination with USGS Emergency Response Team

USGS

5

NASA

ASTER disaster response collects



USGS

6

NASA

Deepwater Horizon Oil Spill

Tasking
May-September, 2010

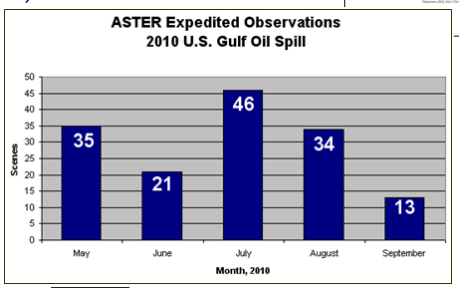
Total 145 Scenes
522,000 km^2

ASTER Tasking Summary

for the

Deepwater Horizon Oil Spill

October 1, 2010



Date 2010	Time UTC	Channels	Day/Night	Image Success?	Expedited Scenes
Sat - 1 May	16:43	VNIR, TIR	Day	Acquired, clear	3
Mon - 3 May	16:31	VNIR	Day	Acquired, cloudy	3
Fri - 7 May	4:00	TIR	Night	Acquired, clear	4
Sat - 8 May	16:49	VNIR, TIR	Day	Acquired, pt. cloudy	4
Mon - 10 May	16:37	VNIR, TIR	Day	Acquired, clear	5
Sat - 15 May	16:55	VNIR, TIR	Day	Acquired, pt. cloudy	4
Mon - 17 May	16:43	VNIR, TIR	Day	Acquired, pt. cloudy	3
Mon - 24 May	16:49	VNIR, TIR	Day	Acquired, clear	4
Wed - 26 May	16:37	VNIR, TIR	Day	Acquired, pt. cloudy	5
Wed - 9 June	16:49	VNIR, TIR	Day	Acquired, clear	4
Fri - 11 June	16:37	VNIR, TIR	Day	Acquired, pt. cloudy	5
Fri - 25 June	16:49	VNIR, TIR	Day	Acquired, pt. cloudy	4
Sun - 27 June	16:37	VNIR	Day	Acquired, pt. cloudy	4
Tues - 29 June	16:25	VNIR	Day	Acquired, cloudy	4
Sun - 4 July	16:43	VNIR, TIR	Day	Acquired, pt. cloudy	4
Tues - 6 July	16:31	VNIR	Day	Acquired, cloudy	4
Thur - 8 July	16:18	VNIR	Day	Acquired, clear	4
Tues - 13 July	16:37	VNIR, TIR	Day	Acquired, pt. cloudy	4
Thur - 15 July	16:25	VNIR	Day	Acquired, pt. cloudy	4
Sun -18 July	16:55	VNIR, TIR	Day	Acquired, pt. cloudy	2
Tues - 20 July	16:43	VNIR, TIR	Day	Acquired, pt. cloudy	3
Thur - 22 July	16:31	VNIR, TIR	Day	Acquired, pt. cloudy	5
Sat - 24 July	16:18	VNIR	Day	Acquired, pt. cloudy	4
Tues - 27 July	16:49	VNIR, TIR	Day	Acquired, pt. cloudy	3
Thur - 29 July	16:37	VNIR, TIR	Day	Acquired, pt. cloudy	5
Sat - 31 July	16:25	VNIR, TIR	Day	Acquired, pt. cloudy	4
Tues - 3 Aug	16:55	VNIR	Day	Acquired, pt. cloudy	4
Thur - 5 Aug	16:43	VNIR, TIR	Day	Acquired, pt. cloudy	5
Sat - 7 Aug	16:31	VNIR, TIR	Day	Acquired, pt. cloudy	4
Mon - 9 Aug	16:18	VNIR, TIR	Day	Acquired, pt. cloudy	3
Thur - 12 Aug	16:49	VNIR, TIR	Day	Acquired, cloudy	3
Sat - 14 Aug	16:37	VNIR	Day	Acquired, pt. cloudy	4
Mon - 16 Aug	16:25	VNIR	Day	Acquired, pt. cloudy	4
Thur - 19 Aug	16:55	VNIR	Day	Acquired, pt. cloudy	4
Sat - 21 Aug	16:43	VNIR, TIR	Day	Acquired, pt. cloudy	3
Sat - 4 Sept	16:55	VNIR	Day	Acquired, pt. cloudy	2
Mon - 6 Sept	16:43	VNIR, TIR	Day	Acquired, pt. cloudy	4
Mon - 20 Sept	16:55	VNIR	Day	Acquired, cloudy	3
Fri - 24 Sept	16:31	VNIR	Day	Scheduled	
ASTER data acquired through 9/20:				522,000 square km	145

USGS science for a changing world

Toxic red sludge from a breached reservoir at an aluminum plant in western Hungary. The flow impacted villages and eventually reached the Danube River.

Australian Flooding

Flooding at
Condamine,
Queensland
Australia

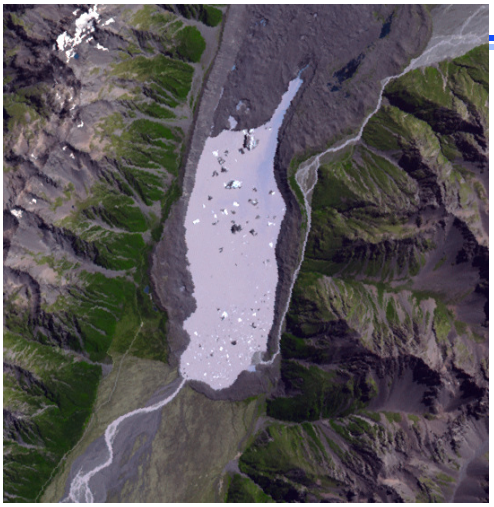
January 23, 2011

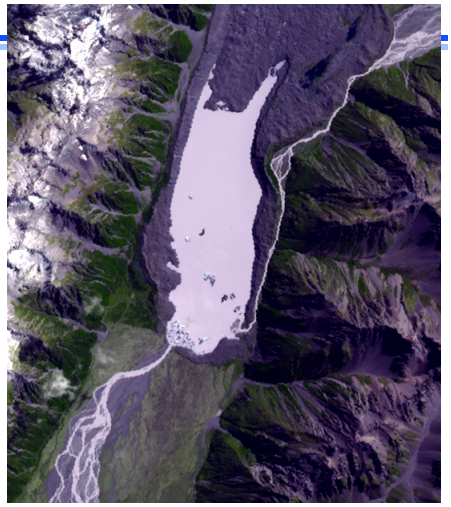
USGS

9

NASA

Tasman Lake, New Zealand





Pre-Earthquake February 17, 2009 22:38 UTC

Post-Earthquake, March 2, 2011 22:43 UTC

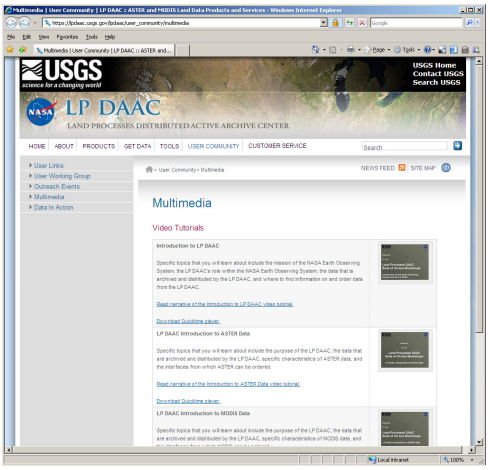
Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) simulated natural color views using visible and near-infrared (VNIR) wavelengths at 15m ground resolution.

USGS

NASA

LP DAAC Outreach

- Provided support at (7) conferences during FY10
  - (3) in support of OneData booth
  - (3) in support of OneNASA booth
  - (1) NASA support
- Investigating new methods of reaching users
  - Online multimedia
  - Social Media



USGS

NASA

Data Access & Interoperability

- Recent Access Improvements
- ESDIS Technology Infusion Activities
- Planned activities

USGS

NASA

Recent Data Access Enhancements

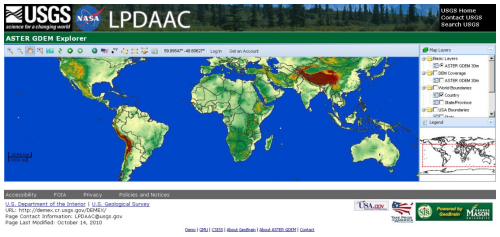
- DEM Explorer
  - Collaboration with George Mason University (GMU) to reuse software that is part of the GeoBrain infrastructure
  - Provides ASTER Global DEM user community a visual selection/download interface
- Earth Explorer
  - Leverage USGS/EROS Interface
  - Enables Cross-Archive (LP DAAC, USGS Landsat, USGS LTA) data discovery and download
- ASTER L1B expansion
  - Expanded "free and open" access to full archive over U.S. and Territories (previously limited to most recent two years)

USGS

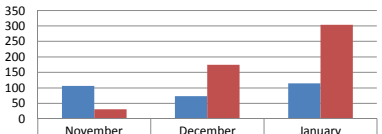
NASA

ASTER Global DEM Explorer

- Collaboration with George Mason University (Liping Di)
- Features include:
  - Visual selection interface
  - Multiple area of interest selection options (including state/county)
  - Mosaicing / Subsetting
  - Multiple output formats (incl. GeoTIFF)
  - Integration with ECHO User Registration
  - OGC standards-based (WMS, WCS)
- Promoted at:
  - ASPRS (November 2011)
  - AGU (December 2011)
- http://demex.cr.usgs.gov/DEMEX/



DEM Explorer Usage Trend



	November	December	January
Users	106	73	114
Volume (GB)	30.5	175	304

USGS

NASA

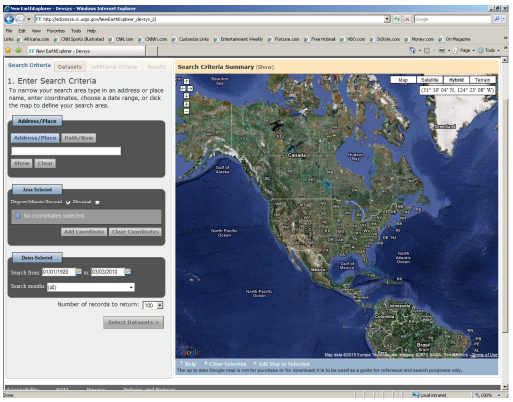
Leveraging USGS "Earth Explorer"

(NEW) Earth Explorer

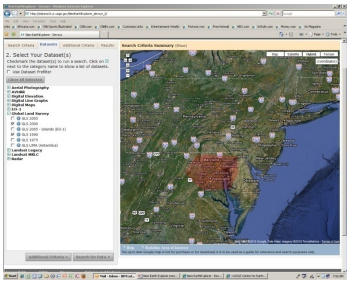
- Cross-dataset search/access
- Direct download from archive
- Significant upgrade from previous Earth Explorer
- Future LDCM data access client

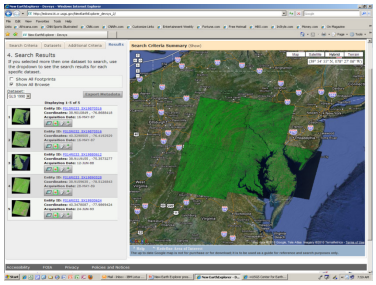
Earth Explorer Features

- Map viewer for viewing overlay footprints and browse overlays.
- Full Resolution Browse display capability.
- Provides KML access through Google Earth.
- User authentication service through user registration and validation routines.
- Allow multi-point polygon and point searches.
- Add on-demand products to an item selection basket.
- Supports standard product downloads.
- XML, KML, CSV, FGDC, Shape file export options.
- http://edcsns17.cr.usgs.gov/NewEarthExplorer/



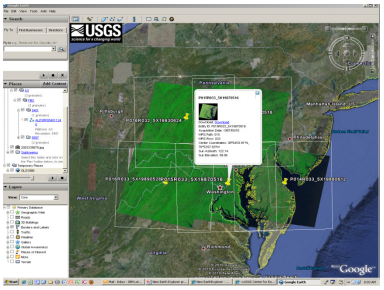
Earth Explorer Features





[above]
- Cross archive search enables access to Landsat, ASTER, MODIS, SRTM, EO-1, AVHRR, etc…

[right]
- Search results exported to Google Earth
- Downloads directly from Google Interface

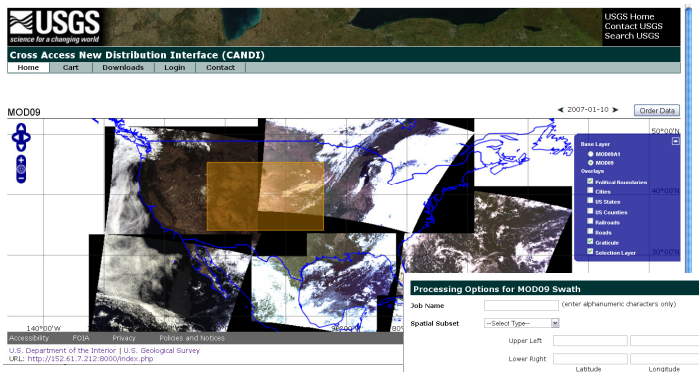


[above]
- Browse and metadata displayed with search results
- Overlay on map

Technology Infusion Activities

- Cross Archive Search and Distribution
  - Objective: Demonstrate Future Data Access and Processing Concepts by enabling visual selection and processing of data remotely archived
    - Data access latency is no longer an impediment
    - Physical location of data storage is irrelevant
    - Services invoked by machine-machine interfaces
    - Custom processing provides only the data needed
  - Collaboration with MODAPS
- Simple Subset Wizard
  - Objective: Demonstrate simple search mechanism for ECHO (using OpenSearch) and web service call(s) to DAACs to subset search results
  - Collaboration with GES DISC
- LP Metadata in Mercury
  - Objective: Extend the existing Mercury interface to include LP DAAC collection and granule level metadata
  - Collaboration with ORNL

Cross Archive Search and Distribution



[above]

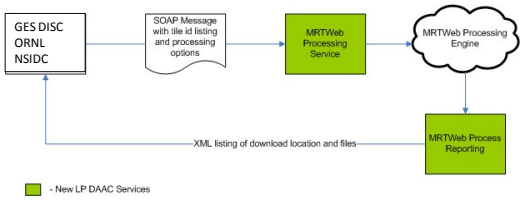
- Visual search / selection of data from external archive (MOD09 Swath Data from MODAPS in this view)
- Layers, selection mechanisms, and other design concepts borrowed from operational interfaces such as GloVis, DEM Explorer

[below]

- Processing options available on selected data based on operational MRTWeb interface

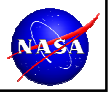
Simple Subset Wizard

- GES DISC collaborated with LP (and other DAACs) on a proposal to:
  - Develop a simple search mechanism to ECHO (using OpenSearch)
  - Call DAAC-specific subsetting services for the search results
- LP DAAC built web services around the existing MODIS Reprojection Tool (MRT) used by the MRTWeb Interface to support subsetting
  - Also supports Mosaicing and Reprojection
  - Will be extended to Swath data using MRTSwath tool



USGS

19

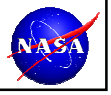


Planned Data Access Enhancements

- Updates to DEMEX
  - Enable additional datasets (SRTM, Blue Marble)
  - Provide additional output formats (JPEG)
  - Area of Interest selection using shape files
- MODIS V006
  - Upon completion of MODIS V006 re-processing campaign, V005 and V006 will be available to users
- Temporal data selection
  - Follow-on to SDRP prototyping
  - Collaboration with REVERB to implement operationally

USGS

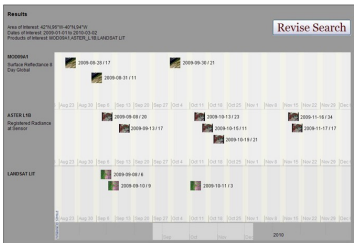
20



Next Generation ESDIS Search Interface

[CURRENT] REVERB ECHO Interface

- In Beta Testing
- Meetings with Reverb Team and LP week of 2/21



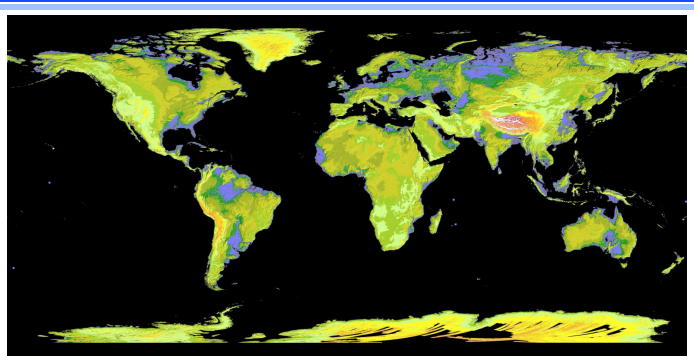
[FUTURE] Temporal Search Results (from SDRP activity)

- LP Prototype information shared with REVERB team
- Plans to develop REVERB temporal search results interface during 2011 (collaboration with LP)

New Data Sets

- ASTER GDEM
- Determine availability of MODIS evapo-transpiration products
- N. American ASTER Land Surface Emissivity Database
- MEaSUREs

ASTER Global Digital Elevation Model



Developed jointly by the Japan's Ministry of Economy, Trade, and Industry (METI) and the US National Aeronautics and Space Administration (NASA).

- 1 arc-sec global coverage (1^o x 1^o "tiles")
- Unprecedented latitude extent (83^oN to 83^o S)
- Available at no cost to all users worldwide, subject to re-distribution and citation policy
- Validated by USGS & international partners

USGS

NASA

ASTER Global DEM GEO Case Study

- Background
  - The ASTER Global DEM (GDEM) demonstrated the impact of moving from "Full and Open" distribution to "Free and Open" distribution.
- Previous Situation
  - METI and NASA have provided the user community with full and open access to ASTER data products since launch in 1999. An ASTER standard (scene-based) DEM product has been distributed since 2001 for a cost-of-recovery fee.
- Change in Situation
  - A new product, the ASTER Global DEM (GDEM), was contributed by METI and NASA to the GEOSS and released for distribution at no charge to all users on June 29, 2009.

USGS

NASA

GDEM Case Study: Lessons Learned

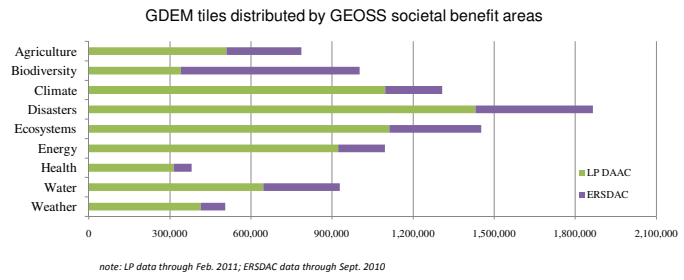
- Considerable demand for the Global DEM
  - Especially for high latitude studies, disaster management.
  - Early requests challenged our distribution systems.
- Community of user includes not only large institutions, but as well "citizen scientists" and educators (affordability).
- Registration is valuable to understanding and characterizing the user community.
- Bandwidth limitations can restrict distribution of large datasets to users
  - LP DAAC now provides hard drive distribution of the entire GDEM dataset upon request.
- Users interested in visual search / access to data
  - LP DAAC, collaborating with George Mason University, implemented the DEM Explorer in October 2010 to enable visual selection and user-defined areas of interest.

USGS

NASA

ASTER Global DEM

- High Demand Continues
  - LP DAAC has distributed over 6.7M GDEM tiles to over 27k users



note: LP data through Feb. 2011; ERSDAC data through Sept. 2010

USGS

NASA

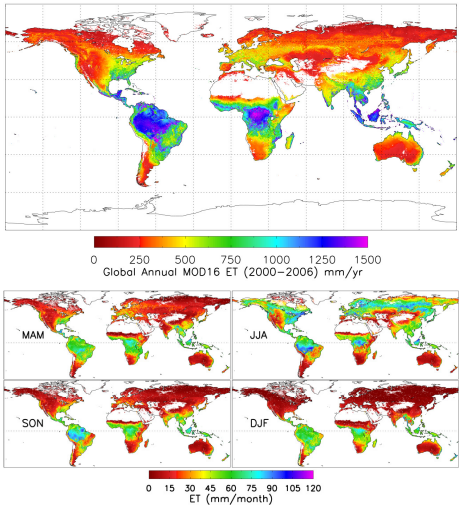
ASTER GDEM v2.0 validation & release

- Validation begins in April 2011
  - Release in August
- Continuing contributions:
  - US (USGS) - CONUS
  - US (NGA) - global
  - Japan (METI/ERSDAC) – Japan
- New contributions
  - Horizontal resolution study (NASA/JPL)
  - IceSat global validation (NASA/GSFC)

USGS

NASA

MOD16 Evapotranspiration

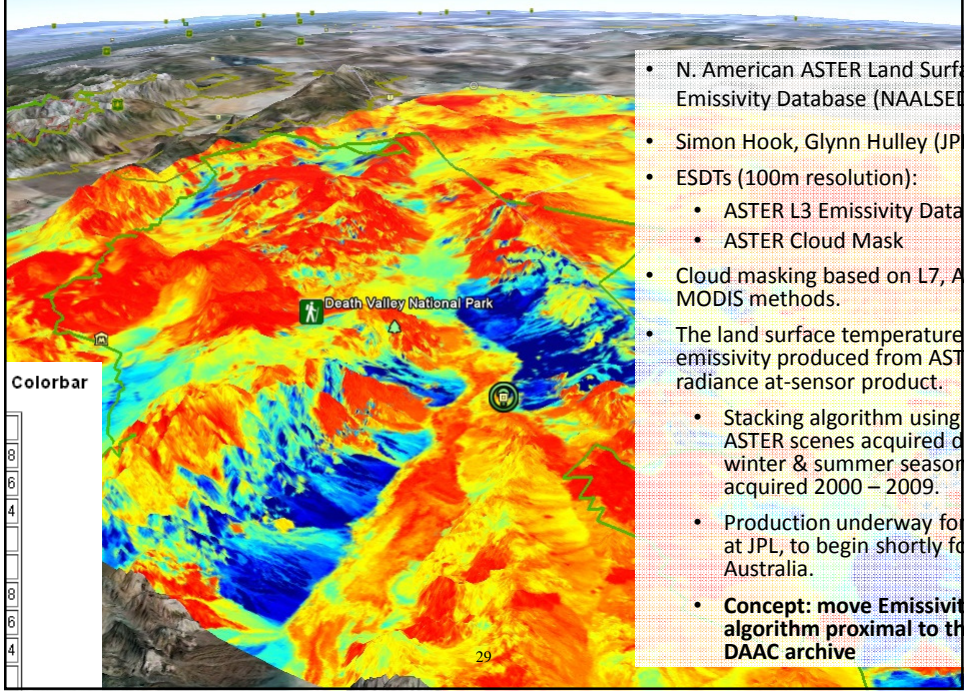


- Part of the original MODLAND products suite, but not produced through MODAPS (U MT - Running)
- Qiaozhen Mu, PI (U. MT)
- ATBD is being drafted for NASA review
- MODIS/Terra Land Surface ET suite:
  - L4 Global 1km SIN Grid V005
  - 2000-2010
  - 8-day (145k tiles, 301 GB)
  - Monthly (38k tiles, 86 GB)
  - Yearly (3146 tiles, 9 GB)

USGS

NASA

ASTER Emissivity Grid



- N. American ASTER Land Surf
  Emissivity Database (NAALSE
- Simon Hook, Glynn Hulley (JP
- ESDTs (100m resolution):
  - ASTER L3 Emissivity Data
  - ASTER Cloud Mask
- Cloud masking based on L7, A
  MODIS methods.
- The land surface temperature
  emissivity produced from AST
  radiance at-sensor product.
  - Stacking algorithm using
    ASTER scenes acquired d
    winter & summer seasor
    acquired 2000 – 2009.
  - Production underway fo
    at JPL, to begin shortly fo
    Australia.
  - **Concept: move Emissivit
    algorithm proximal to th
    DAAC archive**

29

MEaSUREs & the LP DAAC

PI	Short Title	Total volume @ Eno-of-production	LP DAAC assistance requested for transition	Collaboration Status with LP	Next Steps
Didan	**Vegetation Index & Phenology**	6 Tb (total) <1Tb/year	Prototype distribution @ LP DAAC, metric collection, ECHO integration, tier 1 user service model, client.	LP DAAC staff are Co-Investigators on MEaSUREs VIP (& funded for scoped effort)	Initiate incorporation pending March 2011 review FY12: ingest -> distribution FY13: user support FY14; operational
Roy	**Web-enabled Landsat**	4.5 Tb/year 31.5 Tb (7 years)	Request from PI to have UWG assist with evaluation. Distribute raw WELD tiles from LP DAAC (with ECHO integration) – FY12	USGS Landsat Project staff are co-investigators. Prototype distribution systems at USGS/EROS (not LP). Non-LP client & architecture.	Initiate incorporation pending March 2011 review FY12: ingest -> distribution FY13: user support FY14; operational
Townshend	**Global Forest Cover Change**	78Tb (GFCC+TOA+SR) 42Tb (GFCC+SR) 6Tb (GFCC only)	Ingest, file formats, ECHO integration, distribution and user service model by end of performance period.	Review April 2010	GFCC Science Review meeting, in April, 2010.
Kobrick	**Definitive Global DEM**	~1Tb	Ingest, file formats, ECHO integration, distribution and user service model by end of performance period.	Contacted – possible change of scope for blended ASTER GDEM/SRTM product	ASTER Science Team meeting (Dec'10) discussions – preparing for large AST14DTO order.

USGS

NASA

New Missions

- Landsat Continuity
  - LDCM & beyond
  - Archive improvements & consolidation
  - USGS Essential Climate Variables
- Access of land community users to data from upcoming missions

USGS

NASA

National Land Imaging **+$48.0 million**

A new account is proposed for Landsat missions. Landsat furthers the Department of the Interior's important role in land and remote sensing under the President's National Space Policy and provides invaluable data for land use and climate change research. The new account will include **funding for current satellites (Landsats 5 and 7); the Landsat Data Continuity Mission (Landsat 8)**, which is scheduled to **launch in December 2012**; and the **development of Landsats 9 and 10**, through a continuous Landsat program that will ensure data continuity in the future.

"There is no commercial replacement for the breadth and depth of data collected by Landsat satellites, which are then used in a multitude of ways by the agricultural, water management, disaster response, and scientific communities," said Director McNutt. "Because Landsat enables us to see Earth's surface so clearly, so broadly, so objectively, we gain invaluable insights about the complexity of Earth systems and the condition of our natural resources."

USGS

NASA

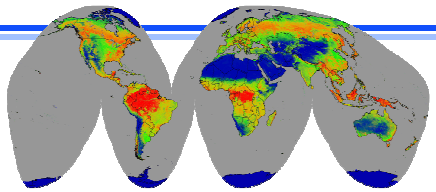
Landsat Archive Activities

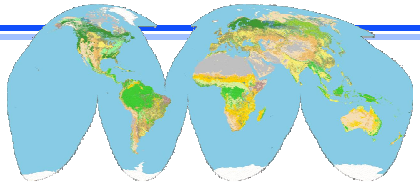
-
  - Landsats 1-3 intervals data missing ephemeris information
  - Over 170,000 full scenes recovered
  - 106,335 NEW scenes added to the US archive
-
  - Repatriate all internationally-acquired Landsat data
  - Nearly 5 million scenes in international archives
  - Collected 298,000 images thus far
-
  - Continued Landsat 7 production
  - Improvements to Landsats 4, 5 processing
  - Improvements to MSS processing
  - **Extends "science quality" data back to 1972**

USGS

NASA

GEO Global 30m Land Cover Products





Annual land cover continuous variables

- Quantitative annual continuous measures of per pixel percent tree, shrub, herbaceous, water, snow/ice, and barren cover.
- Change products

Mid-decadal year land cover types

- Land cover categories (TBD) consistent with FAO Land Cover Classification System (LCCS)
- Maps and statistical estimates of major land cover types
- Complementary with other global land cover products (e.g., MODIS land cover, Globecover)

USGS

NASA

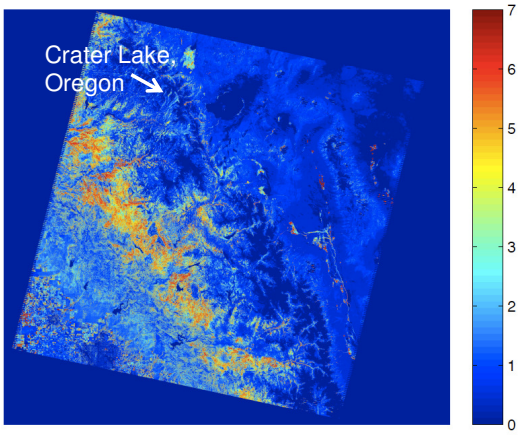
Essential Climate Variables from Landsat

•USGS is developing a suite of "essential climate variables" (ECVs), largely based on Landsat (GCOS definitions).

•Although not "MEaSUREs" ESDRs, still of interest to the land processes community.

•Should these be discoverable and distributable through EOSDIS?

• Current focus:
- Surface reflectance (Masek, Roy)
- Surface temperature (Hook, Schott, utilizes ASTER emssivity grid),
- LAI/fPAR (Nemani, based on MODIS algorithm)
- Global 30m GEO land cover (Loveland)



LAI from Landsat, Courtesy of Rama Nemani, NASA Ames

USGS

NASA

Upcoming Missions

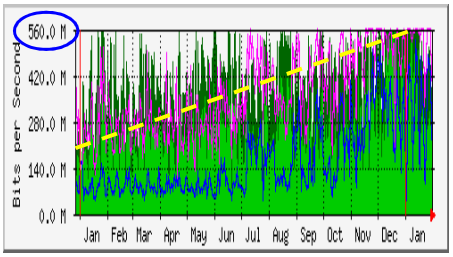
- NPP VIIRS:
  - LP DAAC UWG is requesting access to "LandPEAT" products on behalf of land process community.
- LP DAAC UWG new missions "white paper"
  - Missions include NPP, LS8, various decadal survey missions, international collaborations such as Sentinel-2, 3
- EV-1: AirMOSS
  - Supporting U of MI to distribute higher level products.
  - Will work w/ORNL to ensure transition to long-term archive.

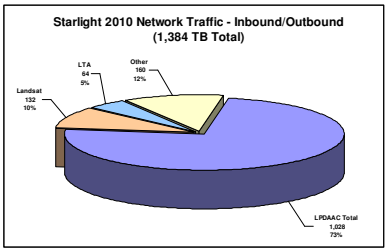
USGS

NASA

Challenge: Distribution Growth Impacts to WAN

- Background:
  - USGS and NASA cost sharing of Wide Area Network (existing OC-12)
  - Circuit utilization has increased substantially in past year, often operating fully saturated – 510 Mbps data





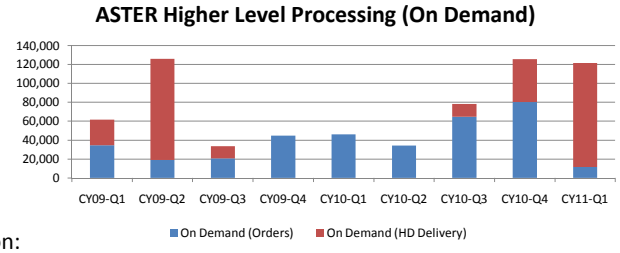
- Resolution:
  - Circuit upgraded to OC-48 (4x capacity) in March 2011
  - No increased cost to NASA

USGS

NASA

Challenge: ASTER On Demand Processing Growth

- Background:
  - Current ASTER Processing Hardware (S4PM) implemented in 2006
  - On Demand capacity peaking at approx. 120k granules/quarter
  - Processing capacity unable to keep up with demand (i.e. Hook Global Emissivity)



- Resolution:
  - Enhanced ASTER processing HW currently being implemented
    - Anticipate 3x processing capability
  - Higher level products now being retained after user request

USGS

NASA


Questions?